

Boolesche Algebra

$$a + b = b + a$$

$$a \cdot b = b \cdot a$$

$$a + b + c = a + (b + c)$$

$$a \cdot b \cdot c = (a \cdot b) \cdot c$$

$$a(b+c) = a \cdot b + a \cdot c$$

$$a + (b \cdot c) = (a + b) \cdot (a + c)$$

$$a + a \cdot b = a$$

$$a \cdot (a + b) = a$$

$$\overline{(a + b + c + \dots)} = \bar{a} \cdot \bar{b} \cdot \bar{c} \cdot \dots$$

$$\overline{(a \cdot b \cdot c \cdot \dots)} = \bar{a} + \bar{b} + \bar{c} + \dots$$

$$a \cdot b + \bar{a} \cdot c = (a + c) \cdot (\bar{a} + b)$$

$$(a + b) \cdot (\bar{a} + c) = a \cdot c + \bar{a} \cdot b$$

$$\bar{a} \cdot \bar{b} + a \cdot b = (\bar{a} + b) \cdot (a + \bar{b})$$

$$(\bar{a} + \bar{b}) \cdot (a + b) = \bar{a} \cdot b + a \cdot \bar{b}$$

$$a + \bar{a} \cdot b = a + b$$

$$a \cdot (\bar{a} + b) = a \cdot b$$

$$\bar{a} + a \cdot b = \bar{a} + b$$

$$\bar{a} \cdot (a + b) = \bar{a} \cdot b$$

$$a \cdot b + a \cdot \bar{b} \cdot c = a \cdot b + a \cdot c$$

$$(a + b) \cdot (a + \bar{b} + c) = (a + b) \cdot (a + c)$$

$$a \cdot b + \bar{a} \cdot c + b \cdot c = a \cdot b + \bar{a} \cdot c$$

$$(a + b) \cdot (\bar{a} + c) \cdot (b + c) = (a + b) \cdot (\bar{a} + c)$$

$$a \cdot b + a \cdot \bar{b} = a$$

$$(a + b) \cdot (a + \bar{b}) = a$$

$$a \cdot b + a \cdot c = a \cdot (b + c)$$

$$(a + b) \cdot (a + c) = a + b \cdot c$$

$$f = (a \cdot \bar{b}) \cdot (b + b) + (b + \bar{b}) \cdot (\bar{a} + a) + (b + 1) \cdot (c + \bar{c}) \quad \checkmark$$

$$f = (b + 1) \cdot a \cdot \bar{a} + a \cdot c + c + b \cdot \bar{c} + c \quad \checkmark$$

$$f = \bar{a} \cdot b \cdot \bar{c} + b \cdot c \cdot (\bar{c} + 1) + a \cdot b \cdot \bar{c} \cdot (a + \bar{a}) \quad \checkmark$$

$$f = a \cdot \bar{b} + a \cdot b \cdot c + a \cdot \bar{b} \cdot c + a \cdot b \quad \checkmark$$

$$f = a \cdot \bar{b} \cdot c + c + d \cdot (a \cdot \bar{b} \cdot c + c) \quad \checkmark$$

$$f = a \cdot \bar{b} \cdot \bar{c} + a \cdot \bar{b} \cdot \bar{c} \cdot d + a \cdot \bar{b} \quad \checkmark$$

$$f = c \cdot d \cdot (a + b + c) \quad \checkmark$$

$$f = (a + \bar{c} + c) \cdot (\bar{a} + c) \cdot (b + c + a + \bar{a}) \quad \checkmark$$

$$f = c \cdot d + a \cdot c \cdot \bar{d} \quad \checkmark$$

$$f = \bar{a} \cdot \bar{b} \cdot c + a \cdot d + \bar{b} \cdot c \cdot \bar{d} \quad \checkmark$$

$$1) f = (a \cdot 0) (b+b) + (b+\bar{b}) \cdot (a \cdot a) + (b+1) \cdot (c \cdot \bar{c})$$

$$0 \cdot (b+b) + 1 \cdot (a \cdot a) + b+1 \cdot a$$

$$\cancel{b+b} + a \cdot a + \cancel{b+1}$$

$$a +$$

$$\boxed{f=a}$$

$$2) f = (b+1) \cdot a \cdot \bar{a} + a + c \cdot c + \cancel{b \cdot 0 + c}$$

$$a + c + c$$

$$\boxed{f=a+c}$$

$$3) f = \bar{a} \cdot b \cdot \bar{c} + b \cdot c (\bar{c}+1) + a \cdot b \cdot \bar{c} \cdot (\bar{a}+\bar{a})$$

$$b(\bar{a} \cdot \bar{c} + c + a \cdot \bar{c}) \rightarrow \cancel{b \cdot a \cdot \bar{c} + c} \quad b \cdot \bar{c} (\bar{a} + \bar{a}) + bc$$

$$b \cdot \bar{c} + bc \rightarrow b(\bar{c} + c) \quad \boxed{f=b}$$

$$4) f = a \cdot \bar{b} + a \cdot b \cdot c + a \cdot \bar{b} \cdot c + a \cdot b$$

$$a \bar{b}(1+1) + a b(1+c) \rightarrow \cancel{a(\bar{b} + bc)} \rightarrow a \bar{b} + ab \rightarrow a(\bar{b} + b)$$

$$\boxed{f=a}$$

$$5) f = (a \cdot \bar{b} \cdot c + e) (d+1) (a \cdot \bar{b} \cdot c + e)$$

$$a \bar{b} c + e (d+1) \rightarrow a \bar{b} c + e$$

$$\boxed{f=a \cdot \bar{b} \cdot c + e}$$

$$6) f = a \cdot \bar{b} \cdot \bar{c} + a \bar{b} \cdot \bar{c} \cdot d + a \cdot \bar{b}$$

$$a \bar{b} \bar{c} (1+d) + a \bar{b} \rightarrow a \bar{b} (\bar{c} + 1) \quad \boxed{f=a \bar{b}}$$

$$7) f = c \cdot d \cdot (a + b + c)$$

$$cd a + cd b + \cancel{cd c} \rightarrow cd (a+b+1) \rightarrow \boxed{f=cd}$$

$$8) f = (a + \bar{c} + c) (\bar{a} + c) \cdot (b \cdot c + a + \bar{a})$$

$$(a \cdot \bar{c} + c) \cdot (\bar{a} + c) \rightarrow \cancel{(a \cdot \bar{c} + c) \cdot \bar{a} + c \cdot \bar{a} + c \cdot c}$$

$$(a \cdot \bar{c} + c) \cdot a \cdot \bar{c} \rightarrow \cancel{a \cdot \bar{c} + c \cdot a \cdot \bar{c}}$$

$$a \cdot \bar{a} \cdot \bar{c} + c \cdot \bar{c} \cdot \bar{a} \quad \boxed{f=0}$$

$$9) f = c \cdot \bar{c} + a \cdot c \cdot \bar{d}$$

$$c(\bar{d} + d) \rightarrow c(d + \bar{d}) \quad \boxed{f=c \cdot (d + \bar{d})}$$

$$10) f = a \cdot \bar{b} \cdot c + a \cdot d + \bar{b} \cdot c \cdot \bar{d}$$

$$\bar{b} c (\bar{a} + d) + a d \rightarrow \cancel{\bar{b} c a d} \quad \bar{b} c a \bar{d} + a d \rightarrow \boxed{f=a d + \bar{b} c}$$

11) a) $f = \bar{a} + \bar{b} + \bar{c} + a \cdot b \cdot c$

~~$\bar{a} + \bar{b} + \bar{c} + \bar{a} + \bar{b} + \bar{c}$~~ $\boxed{f = a \cdot b \cdot c}$

12) b) $f = (\bar{a} \cdot c) + (\bar{b} \cdot d) + a + c$

~~$a + \bar{c} \cdot b + d \cdot \bar{a} \cdot d$~~ $(\bar{a} \cdot c) + (\bar{b} \cdot d) + \bar{a} + \bar{c}$

$(a + \bar{c}) \cdot (b + d) \cdot \bar{a} \cdot \bar{c} \rightarrow \bar{a} \cdot \bar{c} \cdot (a + \bar{c}) \cdot (b + d) \rightarrow (\bar{a} \bar{c} a + \bar{a} \bar{c} \bar{c}) (b + d)$

$\boxed{f = \bar{a} \bar{c} \cdot (b + d)} = (\bar{a} + c) \cdot (b + d) = \overline{(a + c) + (b + d)}$

12) $f = [\bar{a} \cdot \bar{c} + (b + \bar{c})] \cdot d$

$[\bar{a} \cdot \bar{c} + (b + \bar{c})] + \bar{d} \rightarrow (\bar{a} \bar{c}) + (b + \bar{c}) + \bar{d} \rightarrow (a + c) \cdot (b + c) + \bar{d}$

$[\bar{a} \bar{c} + b + \bar{c}] \cdot d \rightarrow [\bar{c} + b] \cdot d \rightarrow \boxed{f = c \cdot (b + d)}$
 $[\bar{c} (a + 1) + b] \cdot d \quad (\bar{c} + b) + \bar{d} \rightarrow$

13) $f = a \cdot \bar{b} \cdot c + a \cdot \bar{c} + b$

$a (\bar{b} c + \bar{c}) + b \rightarrow a (\bar{c} + \bar{b}) + b \rightarrow a \bar{c} + a \bar{b} + b \rightarrow a \bar{c} + a + b$

$a (\bar{c} + 1) + b \quad a + b \quad \boxed{f = a + b}$

14) $f = a + b + c + d$

$f = (\bar{x} \cdot \bar{y} + \bar{x} \cdot y \cdot \bar{z} + x \cdot \bar{y} \cdot \bar{z} + x \cdot y \cdot \bar{z})$

$f = (\bar{x} + y + \bar{z}) \cdot (\bar{x} + y \cdot \bar{z}) \cdot (\bar{x} \cdot \bar{y} + \bar{z}) \cdot (\bar{x} \cdot y + \bar{z})$

$f = (\bar{x} + y + \bar{z}) \cdot (\bar{x} + y \cdot \bar{z}) \cdot (\bar{x} + y + \bar{z}) \cdot (\bar{x} + y + \bar{z})$

\downarrow
 $[(\bar{x} + y) + \bar{z}] \cdot [(\bar{x} + y) + \bar{z}] \cdot [\bar{z} + (\bar{x} + y)] \cdot [\bar{z} + (\bar{x} + y)]$

\downarrow
 $(\bar{x} + y) \cdot [(\bar{z} + (\bar{x} + y)) \cdot (\bar{z} + y)]$

$(\bar{x} + y) \cdot [\bar{z} + \bar{x} \bar{z} + x \bar{z} + y \bar{z} + y \bar{z}] \rightarrow (\bar{x} + y) \cdot (\bar{z} + \bar{x} \bar{z} + x \bar{z} + y \bar{z})$

$\rightarrow \bar{x} \bar{z} + \bar{x} \bar{z} \bar{y} + \bar{x} \bar{z} y + \bar{x} \bar{z} \bar{y} \bar{z} + \bar{x} \bar{z} y \bar{z} + \bar{x} \bar{z} y \bar{z}$

$\bar{x} \bar{z} + \bar{x} \bar{z} \bar{y} + \bar{x} \bar{z} y + \bar{x} \bar{z}$

$\bar{z} (\bar{x} + y) + \bar{x} \bar{z} \bar{y} + \bar{x} \bar{z} y$

$(\bar{x} + y) + (\bar{y} + \bar{x})$

$(\bar{x} + y) (y + \bar{x})$

$\bar{y} (x + \bar{y}) + \bar{x} (x + y)$

$\bar{y} x + \bar{x} \bar{y} \bar{y}$

$\bar{y} x + \bar{x} \bar{y}$

$(\bar{y} + \bar{x}) (\bar{x} + y)$

$x (\bar{y} + \bar{x}) + y (y + \bar{x})$

$x \bar{y} + y \bar{x}$

ED - II - Arithmetik - 004

$$17) a) f = (a+c) \cdot (\bar{a}+b) \cdot (b+\bar{c}+d)$$

$$(a \cdot b + \bar{a} \cdot b) \cdot (b + \bar{c} + d)$$

$$a b b + a b \bar{c} + a b d + \bar{a} c b + \bar{a} c \bar{c} + \bar{a} c d$$

$$a b + a b \bar{c} + a b d + \bar{a} c b + \bar{a} c d$$

$$a b (1 + \bar{c} + d) + \bar{a} c (b + d)$$

$$a b + \bar{a} c b + \bar{a} c d$$

$$b (a + \bar{a} c) + \bar{a} c d$$

$$b (a + \bar{a} c) + \bar{a} c d$$

$$\bar{a} c (b + d)$$

$$f = b (a + c) + \bar{a} c d$$

$$17) b) f = \bar{a} \cdot c + \bar{b} \cdot \bar{c} + a + c$$

$$a + (\bar{a} \cdot c + \bar{b} \cdot \bar{c} + c)$$

$$a + (\bar{a} \cdot c + \bar{b} \cdot \bar{c} + c)$$

$$a + \bar{a} \cdot c + \bar{b} \cdot \bar{c} + c$$

$$a + \bar{a} \cdot c + \bar{b} \cdot \bar{c} + c$$

$$c (b + \bar{b}) + a + c$$

$$c \cdot (b + \bar{b} + 1) + a + c$$

$$c \cdot (b + \bar{b} + 1) + a + c$$

$$\bar{c} b (d + \bar{d}) + a + c$$

$$f = a + c$$

$$f = a + c + \bar{a} \cdot b + b \cdot \bar{c}$$

$$(a + b) \cdot (\bar{a} + c) + b \cdot \bar{c}$$

$$a \bar{a} + a c + b \bar{a} + b c + b \bar{c}$$

$$a c + b (\bar{a} + c + \bar{c})$$

$$f = a + c + b$$

$$18) f = a \cdot \bar{c} + a b \cdot \bar{c} + \bar{a} \cdot \bar{c} \cdot d + a \cdot c \cdot \bar{c} + a \cdot \bar{c} \cdot \bar{d}$$

$$a \bar{c} (1 + b + \bar{d} + \bar{c}) + a c \bar{c} \rightarrow a (\bar{c} + c \bar{c}) \rightarrow a (\bar{c} + \bar{c})$$

$$f(A, B, C, D) = \sum (0, 1, 2, 3, 13, 15)$$

A B C D F

0 0 0 0 1 (0)

0 0 0 1 1 (1)

0 0 1 0 1 (2)

0 0 1 1 1 (3)

0 1 0 0 0 (4)

0 1 0 1 0 (5)

0 1 1 0 0 (6)

0 1 1 1 0 (7)

1 0 0 0 0 (8)

1 0 0 1 0 (9)

1 0 1 0 0 (10)

1 0 1 1 0 (11)

1 1 0 0 0 (12)

1 1 0 1 1 (13)

1 1 1 0 0 (14)

1 1 1 1 1 (15)

$$(\bar{A} \bar{B} \bar{C} \bar{D}) + (\bar{A} \bar{B} \bar{C} D) + (\bar{A} \bar{B} C \bar{D}) + (\bar{A} \bar{B} C D) + (A B \bar{C} D) + (A B C D)$$

$$\bar{A} \bar{B} (\bar{C} \bar{D} + \bar{C} D + C \bar{D} + C D) + A B (\bar{C} D + C D)$$

$$\bar{C} (0 + \bar{D}) + C (\bar{D} + D) + D (\bar{C} + C)$$

$$\bar{C} + C + D$$

$$\bar{A} \bar{B} + A B D$$

$$\{A, B, C\} = \{2, 3, 4, 5\}$$

A	B	C	F	
0	0	0	0	(0)
0	0	1	0	(1)
0	1	0	1	(2)
0	1	1	1	(3)
1	0	0	1	(4)
1	0	1	1	(5)
1	1	0	0	(6)
1	1	1	0	(7)

$$(\bar{A}\bar{B}\bar{C}) + (\bar{A}\bar{B}C) + (\bar{A}B\bar{C}) + (\bar{A}BC)$$

$$\bar{A}\bar{B}(\bar{C}+C) + \bar{A}(B\bar{C}+BC)$$

$$\bar{A}\bar{B} + \bar{A}B + \bar{A}(\bar{C}+C)$$

De Morgan-en abbreken

$$\overline{X \cdot Y \cdot Z} = \bar{X} + \bar{Y} + \bar{Z}$$

$$\overline{X + Y + Z} = \bar{X} \cdot \bar{Y} \cdot \bar{Z}$$

$$\overline{\bar{X} + \bar{Y} + \bar{Z}} = X \cdot Y \cdot Z$$

$$\overline{(A+B+C) \cdot D} = \overline{(A+B+C)} + \bar{D} = \bar{A} \cdot \bar{B} \cdot \bar{C} + \bar{D}$$

$$\overline{ABC + DCF} = \overline{ABC} \cdot \overline{DCF} = (\bar{A} + \bar{B} + \bar{C}) \cdot (\bar{D} \cdot \bar{E} \cdot \bar{F})$$

$$\overline{A \cdot \bar{B} + \bar{C} \cdot D + E \cdot F} = \overline{A \cdot \bar{B}} \cdot \overline{\bar{C} \cdot D} \cdot \overline{E \cdot F} = (\bar{A} + B) \cdot (C + \bar{D}) \cdot (\bar{E} + \bar{F})$$

$$\overline{ABC + D + E} = \overline{ABC} \cdot \bar{D} \cdot \bar{E} = \bar{A} \cdot \bar{B} \cdot \bar{C} \cdot \bar{D} \cdot \bar{E}$$

$$\overline{(A+B) + C} = \overline{(A+B)} \cdot \bar{C} = (\bar{A} \cdot \bar{B}) \cdot \bar{C}$$

$$\overline{(A+B) \cdot CD} = \overline{(A+B)} + \overline{CD} = \bar{A} + \bar{B} + (\bar{C} + \bar{D})$$

$$\overline{(A+B) \cdot \bar{C} \cdot \bar{D} + E + F} = \overline{(A+B)} + \bar{C} + \bar{D} + \bar{E} + \bar{F} = (\bar{A} \cdot \bar{B} + \bar{C} + \bar{D}) \cdot \bar{E} \cdot \bar{F}$$

$$\overline{ABC + (D+E)} = \overline{ABC} \cdot (\bar{D} + \bar{E}) = \bar{A} \cdot \bar{B} \cdot \bar{C} \cdot (\bar{D} + \bar{E})$$

$$\overline{(A+B) \cdot C} = \overline{(A+B)} + \bar{C} = (\bar{A} + \bar{B}) + \bar{C}$$

$$\overline{A+B+C} + \overline{D \cdot E} = \overline{(A+B+C)} + \overline{(D \cdot E)} = \bar{A} + \bar{B} + \bar{C} + \bar{D} + \bar{E}$$

Funktion simplifizieren \rightarrow Karnaugh

11) $A\bar{B}C + \bar{A}\bar{B} + AB\bar{C}D$

$$\cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}} + \cancel{A\bar{B}C\bar{D}}$$

$$\begin{array}{ccccccc} A\bar{B}C\bar{D} & + & A\bar{B}C\bar{D} & + & A\bar{B}C\bar{D} & + & A\bar{B}C\bar{D} \\ 1011 & 1010 & 0011 & 0001 & 0000 & 0010 & 1101 \end{array}$$

$$A\bar{B}C(0+0) + \bar{A}\bar{B}(1+1)(0+0) + AB\bar{C}D$$

12) $A + A\bar{B} + B\bar{C}$

$$\begin{array}{ccccccc} ABC & + & A\bar{B}C & + & A\bar{B}\bar{C} & + & A\bar{B}\bar{C} \\ 111 & 101 & 110 & 100 & 101 & 100 & 110 & 010 \end{array}$$

$$ABC + A\bar{B}C + A\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C}$$

13) $(A+B) \cdot (A+\bar{B}+\bar{C})$

$$(A+B+\bar{C}) \cdot C$$

$$\begin{array}{ccccccc} A+B\bar{C} & + & A+B\bar{C} & + & A+B\bar{C} & + & A+B\bar{C} \\ 001 & 010 & 010 & 010 & 010 & 010 & 010 \end{array}$$

14) $(A+B+C)(\bar{B}+\bar{C}+\bar{D})(A+\bar{B}+\bar{C}+\bar{D})$

$$\begin{array}{ccccccc} (A+B+C+D)(A+B+C+D)(A+B+C+D)(A+B+C+D)(A+B+C+D) \\ 0100, 0101, 0110, 0111, 1000, 1001, 1010, 1011, 1100, 1101, 1110, 1111 \end{array}$$

$$(A+B+C+D)(A+B+C+D)(\bar{A}+\bar{B}+\bar{C}+\bar{D})(\bar{A}+\bar{B}+\bar{C}+\bar{D})$$

Funktion simplifizieren

a) $A \cdot B + A(B+C) + B(B+C)$

$$AB + AB + AC + B + BC$$

$$B(A+1+C) + AC \rightarrow \boxed{A+B}$$

b) $A\bar{B} + A \cdot \overline{(B+C)} + B(B+C)$

$$A\bar{B} + A\bar{B}\bar{C} + B\bar{B}\bar{C}$$

$$\boxed{A\bar{B}}$$

c) $[A \cdot \bar{B}(C+BD) + \bar{A}\bar{B}] \cdot C$

$$(A\bar{B}C + \bar{A}\bar{B}\bar{C})C$$

$$\boxed{\bar{B}C}$$

$$A\bar{B}C + \bar{A}\bar{B}\bar{C} \quad \bar{B}C(A+\bar{A})$$

(d) $\bar{A}\bar{B}C + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$

$$\bar{B}\bar{C}(A+\bar{A}) + BC(A+\bar{A}) + A\bar{B}C$$

$$\bar{B}\bar{C} + BC + A\bar{B}C \quad BC + \bar{B}(\bar{C}+AC)$$

$$BC + \bar{B}(\bar{C}+A) \quad BC + \bar{B}\bar{C} + \bar{B}A$$

(e) $\overline{A \cdot B + AC} + \bar{A} \cdot \bar{B} \cdot C$

$$\overline{A \cdot B} \cdot \overline{AC} + \bar{A} \cdot \bar{B} \cdot C$$

$$(\bar{A}+\bar{B}) \cdot (\bar{A}\bar{C}) + \bar{A}\bar{B}C$$

$$\boxed{\bar{A} + \bar{B}\bar{C}}$$

$$\bar{A} + \bar{A}\bar{C} + \bar{B}\bar{A}\bar{C} + \bar{B}\bar{C} + \bar{A}\bar{B}C$$

$$\bar{A}(\bar{A} + \bar{C} + \bar{B} + \bar{B}\bar{C}) + \bar{B}\bar{C}$$

ED-11: A0111111-101

1) $f(A, B, C, D) = \sum (0, 1, 2, 3, 13, 15)$

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

$$\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D}$$

$$\bar{A}\bar{B}C(\bar{D}+D) + \bar{A}\bar{B}C(\bar{D}+D) + A\bar{B}D(\bar{C}+C)$$

$$\bar{A}\bar{B}(\bar{C}+C) + A\bar{B}D \quad \boxed{\bar{A}\bar{B} + A\bar{B}D}$$

Minimieren von 2. Term:

$$(A+B) \cdot (C+\bar{B})$$

$$(A+B+C) \cdot (A+B+\bar{C}) \quad (A+C+\bar{B}) \cdot (\bar{A}+C+\bar{B})$$

$$\bullet \bullet \bullet \quad \bullet \bullet \bullet \quad \bullet \bullet \bullet \quad \bullet \bullet \bullet$$

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

$$(A+B\bar{C}) \cdot C \quad \text{minimieren zu}$$

$$(AB+AC) \cdot C \quad ABC + ACC \quad ABC$$

2)

A	B	C	E
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

$$a) \quad \overline{AB} \cdot (C+D) + E = \overline{AB} + (C+D) \cdot E$$

$$(A+\bar{B}) + (\bar{C}D) \cdot \bar{E} = A+\bar{B} + \bar{C}D\bar{E}$$

$$c) \quad w = x + y + z$$

$$[\bar{A}\bar{B} \cdot (C+\bar{B}D) + \bar{A}\bar{B}] \cdot CD \rightarrow (ABC + AB\bar{B}D + \bar{A}\bar{B}) \cdot CD \rightarrow [ABC + AB(\bar{B}+D) + \bar{A}\bar{B}] \cdot CD$$

$$[ABC + AB\bar{B} + AB\bar{B}D + \bar{A}\bar{B}] \cdot CD \rightarrow ABCD + AB\bar{B}CD + \bar{A}\bar{B}CD + \bar{B}CD$$

$$ED = \bar{E} \cdot A \cdot C + E \cdot \bar{A} \cdot \bar{C} = 0$$

E	A	C	F
1	0	1	
0	1	1	
1	1	1	

c) $[AB(C + \bar{B}\bar{D}) + \bar{A}\bar{B}]CD \rightarrow [AB(C + \bar{B} + \bar{D}) + \bar{A} + \bar{B}]CD$

$$(ABC + AB\bar{B} + AB\bar{D} + \bar{A} + \bar{B})CD \rightarrow ABCD + AB\bar{B}CD + \bar{A}CD + \bar{B}CD \rightarrow ABCD + \bar{A}CD + \bar{B}CD$$

$$CD(AB + \bar{A} + \bar{B}) \rightarrow CD$$

f) $ABC + \bar{A}\bar{B}C + \bar{A}BC + \bar{A}\bar{B}\bar{C} \rightarrow ABC + \bar{A}(\bar{B}C + B\bar{C} + \bar{B}\bar{C}) \rightarrow ABC + \bar{A}[(C\bar{B} + B) + \bar{B}\bar{C}]$

~~ANNAHWA~~ $ABC + \bar{A}C + \bar{A}\bar{B}\bar{C} \rightarrow ABC + \bar{A}(C + \bar{C}\bar{B}) \rightarrow ABC + \bar{A}C + \bar{A}\bar{B} \rightarrow$

↓
(C + \bar{B})

g) $AB\bar{C} + (BD + CDE) + A\bar{C} \quad | \quad A(\bar{B}CD + \bar{C})$

$$AB\bar{C}BD + AB\bar{C}DE + A\bar{C} \quad | \quad A(\bar{B}CD + \bar{C})$$

h) $w\bar{x}y + \bar{x}y\bar{z} + wxy$

$$w\bar{x}y + w\bar{x}y\bar{z} + w\bar{x}y\bar{z} + w\bar{x}y\bar{z} + w\bar{x}y\bar{z} + w\bar{x}y\bar{z} + w\bar{x}y\bar{z} + w\bar{x}y\bar{z}$$

1011 1010 1001 1000 0111 0110 0101 0100

i) $\bar{x}y + \bar{x}y\bar{z} + \bar{x}\bar{y} + \bar{x}\bar{y}z + \bar{x}\bar{y}\bar{z} + \bar{x}\bar{y}z$

011 010 001 000 101 100 110 111

j) $ABCD + AB\bar{C}D + AB\bar{C}\bar{D} + ABC\bar{D} + \bar{A}BCD + \bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D}$

1111 1101 1100 1011 0111 0110 0101 0100

k) $ABC + \bar{A}BC + \bar{A}B\bar{C} + \bar{A}B\bar{C}$

$$B(\bar{A}C + \bar{A}\bar{C}) + B(\bar{A}\bar{C} + \bar{A}C)$$

↓

$$B[\bar{A}(C + \bar{C})] + B\bar{A}\bar{C} + B\bar{A}C$$

$B\bar{A} + B\bar{A}\bar{C} + B\bar{A}C$	$B(\bar{A} + \bar{A}\bar{C})$	$B(\bar{A})$
$B\bar{A}(1 + \bar{C}) + B\bar{A}\bar{C}$	$B\bar{A} + B\bar{A}\bar{C}$	
$B\bar{A} + B\bar{A}\bar{C}$	$B(\bar{A} + \bar{C})$	

$(A + B\bar{C})$...

$$A\bar{C} + B\bar{C}\bar{C}$$

$$A\bar{C}B + A\bar{C}\bar{B}$$

$$A\bar{C} + A\bar{C}$$

111 101

A	B	C	F
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

$$\sum (1, 4)$$

$$(A+C)(AB+AC)$$

$$AAB + AAC + ABC + ACC$$

$$AB + AC + ABC + AC$$

$$ABC + ABC + ABC + ABC + ABC$$

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$$\Sigma (5,6,7)$$

$$(A+B)(C+B)$$

$$AC + AB + BC + BB$$

$$ABC + ABC + ABC + ABC + ABC + ABC$$

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$$\Sigma (7,5,4,3)$$

$$ABC + AB + ABC$$

$$1010 \quad 0000 \quad 1101$$

A	B	C
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

A	B	C	D	F
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

$$\Sigma (0,1,2,3,10,11,13)$$

$$A + AB + BC$$

$$100 \quad 100 \quad 010$$

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

$$\Sigma (2,4,5,6,7)$$

$$(A+B) \cdot (B+C)$$

$$010 \quad 000$$

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

$$\Pi (0,2,3,4)$$

$$(A+B)(A+B+C)$$

$$000 \quad 011$$

$$\Pi (0,1,3)$$

$$(A+B+C) \cdot (B+C+D) \cdot (A+B+C+D)$$

$$0100 \quad 0101 \quad 0110$$

$$\Pi (4,5,6,13)$$

$$(A+B+C) \cdot (A+B+C) \quad \Pi (1,2)$$

$$010 \quad 000$$

$$A(A+C) \cdot (A+B)$$

$$\Pi (0,1,2,3)$$

$$000 \quad 001 \quad 000$$

$$(A+B)(C+B)$$

$$001 \quad 001$$

$$\Sigma (5,6,7)$$

$$AC + AB + BB + BC$$

$$001 \quad 100 \quad 011$$

$$\Sigma (3,4,5,7)$$

$$\bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + \bar{A}BC$$

$$\overline{B}C(A+\overline{A}) + BC(A+\overline{A}) + A\overline{B}C$$

$$\overline{B}C + BC + A\overline{B}C$$

$$C(B + \bar{A}\bar{B}) = CB + C\bar{A}$$

$$\overline{BC} + AC + BC$$

$$\begin{array}{r} \overline{A+B} \\ \hline \overline{A+B} \end{array}$$

Fonttest 2 NAMDe-arabe

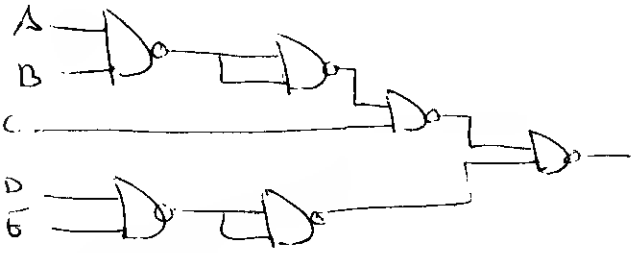
$$e) \overline{ABC + DE} = \overline{ABC} \cdot \overline{DE} = \overline{ABC} \cdot \overline{DE}$$

b) ~~$AB + DE$~~

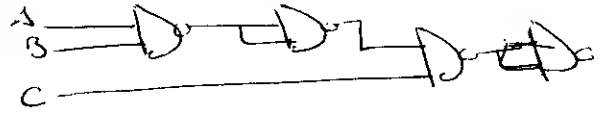
~~$$ABC \cdot (\bar{D} + E) = \bar{A}BC \cdot (\bar{D} + E)$$~~

~~$$\overline{ABC} \cdot (\overline{D+E}) = \overline{ABC} \cdot \overline{DE}$$~~

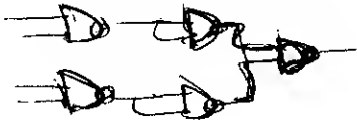
$$ABC + \overline{D} + \overline{E} = ABC + \overline{DE} = \overline{\overline{ABC} \cdot \overline{DE}} = \overline{\overline{ABC}} \cdot \overline{\overline{DE}}$$



c) $\Delta BC = \overline{\Delta BC}$

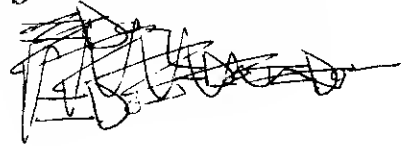


$$d) \overline{AB + CD} = \overline{AB \cdot CD} = \overline{\overline{AB} \cdot \overline{CD}}$$



e) $\overline{(A+B)} \cdot (C+D) = \overline{AB} \cdot \overline{CD}$

$$\overline{AB} \cap \overline{CD} \quad (\overline{AB}) \cap \overline{CD}$$

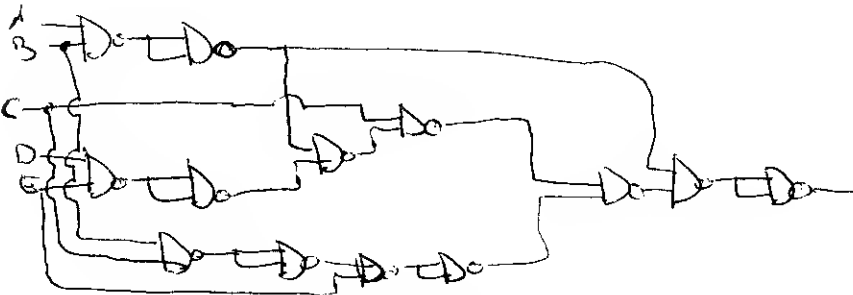
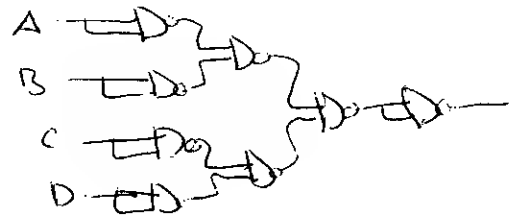


4) $AB [C(DE + \overline{AB}) + \overline{BCE}]$

$$\overline{AB} \cdot \overline{C \cdot DE} \cdot \overline{AB} \cdot \overline{BCE}$$

$$\quad \quad \quad \downarrow$$

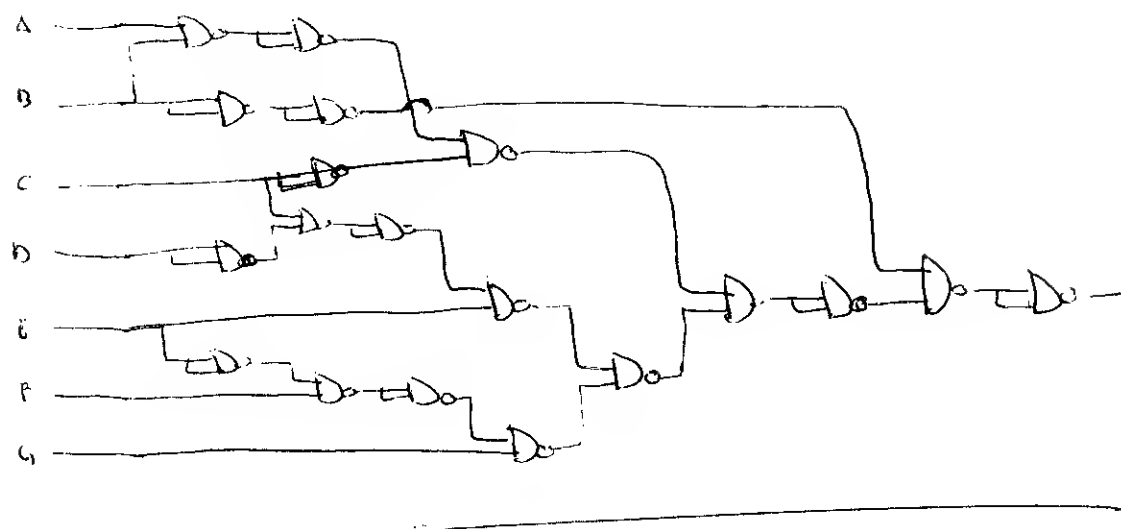
$$\quad \quad \quad \overline{BCE}$$



9) $B(C\bar{D}E + \bar{E}FG)(\bar{A}B + C)$

$\bar{A} \cdot \bar{B} \cdot \bar{C}$

$\bar{B} \quad \bar{C} \bar{D} E \cdot \bar{E} F G \quad \bar{A} B \quad C$



Aufgabenstellung: le. 10

$f_1 = \bar{A}C + A\bar{C}D + \bar{A}BCD$

~~$[A\bar{C}B\bar{D} + A\bar{C}B\bar{D} + A\bar{C}B\bar{D} + A\bar{C}B\bar{D} + A\bar{C}B\bar{D} + A\bar{C}B\bar{D} + A\bar{C}B\bar{D} + A\bar{C}B\bar{D}]$~~

0000 1001 0111
0001 1101
0100
0101

$\bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D}$

$f_2 = \bar{A}CD + AC + ABC$ $(\bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D} + \bar{A}\bar{C}B\bar{D})$
 $\bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B}$
 $\bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B} + \bar{A}CD\bar{B}$

$f_3 = \bar{A}B + AC$

$\bar{A}BCD + \bar{A}BC\bar{D} + \bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D} + \bar{A}BCD + \bar{A}BC\bar{D} + \bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D}$

$f_4 = (A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})$ 0101 | 1101 | 0111 | 1111
 $(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})$ 0100 | 0110 | 0111 | 0111
 $(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})$ 0111 | 1001 | 0111 | 0111
 $(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})$ 0111 | 0111 | 0111 | 0111

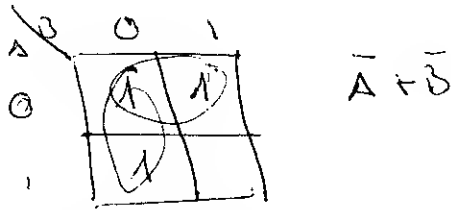
$(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})$
 $(A + \bar{B} + C + \bar{D})(\bar{A} + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})(A + \bar{B} + C + \bar{D})$

$$f_5 = (x_1 + x_3 + x_2 + x_4) (x_1 + x_3 + x_2 + x_4) (x_1 + x_3 + x_2 + x_4) (x_1 + x_3 + x_2 + x_4)$$

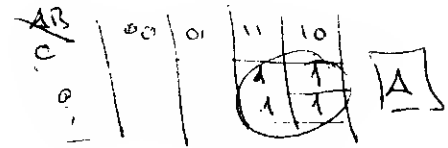
0 x 0 x x

KARNAUGH

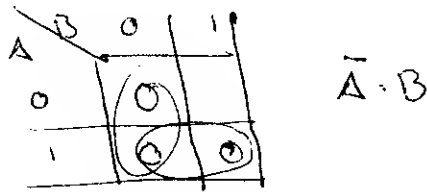
2.1 $F = \bar{a} \cdot b + \bar{a} \cdot \bar{b} + a \cdot \bar{b}$
 01 00 10



2.5 $F = a \cdot b + a \cdot c + a \cdot \bar{b} \cdot \bar{c}$
 110 101 100
 111 111 111



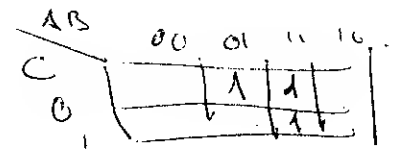
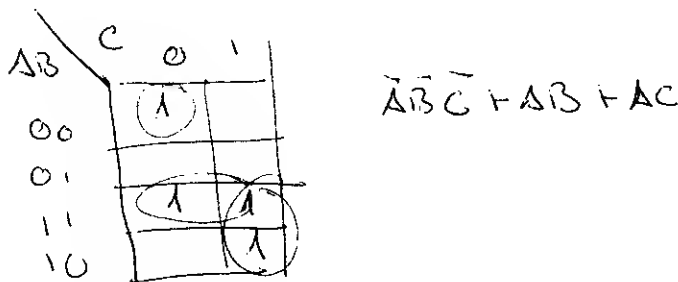
2.2 $F = (\bar{a} + \bar{b}) (\bar{a} + b) (a + b)$
 11 10 00



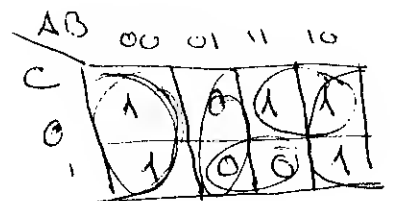
2.6 $F = b \cdot (a + \bar{c}) \cdot (\bar{a} + b + \bar{c})$
 $(a \cdot b + b \cdot \bar{c}) (\bar{a} + b + \bar{c})$

$a \cdot b \cdot \bar{c} + a \cdot b \cdot c + \bar{a} \cdot b \cdot \bar{c} + \bar{a} \cdot b \cdot c + b \cdot \bar{c} \cdot \bar{c} + b \cdot \bar{c} \cdot c$
 $a \cdot b + \bar{a} \cdot b + b \cdot \bar{c}$
 $b \cdot (a + \bar{a}) + b \cdot \bar{c}$
 $b \cdot 1 + b \cdot \bar{c}$
 $b \cdot (1 + \bar{c})$
 $b \cdot 1$
 b

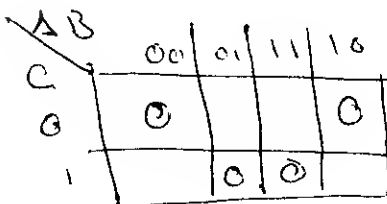
2.3 $F = a \cdot b \cdot c + \bar{a} \cdot \bar{b} \cdot \bar{c} + a \cdot b \cdot \bar{c} + a \cdot \bar{b} \cdot c$
 111 000 110 101



2.4 $F = (a + b + c) (\bar{a} + b + c) (a + \bar{b} + \bar{c}) (\bar{a} + \bar{b} + \bar{c})$
 000 100 011 111



$\bar{B} + A \cdot \bar{C}$
 $(A \cdot \bar{B}) \cdot (\bar{B} + \bar{C})$



2.10

AB \ C	00	01	10	11
0	0	0	0	0
1	1	0	1	1

min $\bar{A}\bar{B}C + ABC + A\bar{B}C$

max $(A+B+C)(A+\bar{B}+C)(\bar{A}+B+C)(\bar{A}+B+C)(A+\bar{B}+\bar{C})$

2.9 $F = a \cdot b \cdot c + a \cdot \bar{b} \cdot c + a \cdot b \cdot \bar{c} + \bar{a} \cdot \bar{b} \cdot \bar{c} + \bar{a} \cdot b$

111 101 110 000 010 011

$\bar{A}\bar{C} + A\bar{B} + B$

AB \ C	0	1
00	1	
01	1	1
11	1	1
10		1

2.10

min $\bar{B}\bar{C} + AB$

max $(A\bar{C}) \cdot B$

2.11

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

AB \ C	00	01	11	10
0	1	0	0	1
1	0	0	0	1

$A\bar{B} + \bar{B}\bar{C}$ min

$\bar{B} + (A+C)$ max

2.12

a	b	c	f
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

AB \ C	0	1
00		
01	0	0
11		
10		

$A + \bar{B}$

2.13

a	b	c	f
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

AB \ C	00	01	11	10
0	1	0	0	0
1	1	1	1	1

$\bar{C} + \bar{A}\bar{B}$ min

$\bar{C} + (A+B)$ max

Kon. bilden erhalten $\rightarrow C$

! Bitte selbstgelesen und die besseren erabillig!

• Auch bachelorge, erabillig d. h. g. bestell ex

2.14

a	b	c	f
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

AB \ C	0	1
00	1	1
01	0	1
11	1	1
10	1	1

maxterms
 $(A+B)(\bar{A}+C)$
 minterms
 $\bar{A}\bar{B}+C$

2.15

$$F = \bar{a} \cdot \bar{b} \cdot \bar{c} \cdot \bar{d} + \bar{a} \cdot \bar{b} \cdot c \cdot d + \bar{a} \cdot \bar{b} \cdot c \cdot \bar{d} + \bar{a} \cdot b \cdot \bar{c} \cdot d + a \cdot b \cdot \bar{c} \cdot d + a \cdot b \cdot c \cdot \bar{d} + a \cdot b \cdot c \cdot d$$

0000 0011 0010 0101 1101 1110 1001

AB \ CD	00	01	11	10
00	1		1	1
01		1		
11		1		1
10		1		

$$A\bar{C}D + B\bar{C}D + \bar{A}B\bar{D} + \bar{A}B\bar{C} + A\bar{B}C\bar{D}$$

2.16

$$F = (a+b+c+d) \cdot (a+b+c+d) \cdot (\bar{a}+\bar{b}+\bar{c}+\bar{d}) \cdot (a+b+c+d) \cdot (a+b+c+d)$$

0001 0000 1111 0101 0010

AB \ CD	00	01	11	10
00	0	0		0
01		0		
11			0	
10				

2.17

$$F = a \cdot \bar{d} + b \cdot \bar{d}$$

1000	0100
1010	0110
1100	1100
1110	1110

AB \ CD	00	01	10	11
00				
01	1		1	
10	1		1	
11	1		1	

2.18

$$F = (a+c)(a+b)(\bar{a}+b+\bar{d})$$

0000	0100	1001
0001	0101	1011
0100	0110	
0101	0111	

AB \ CD	00	01	11	10
00	0	0		
01	0	0		0
11		0		0
10		0		

2.19 $F = \bar{a} \cdot \bar{b} \cdot \bar{c} \cdot \bar{d} + a \cdot \bar{b} \cdot \bar{c} \cdot \bar{d} + \bar{a} \cdot \bar{b} \cdot c \cdot d + \bar{c} \cdot b \cdot \bar{c} \cdot d + ab\bar{c}d + \bar{a}\bar{b}cd + \bar{a}b\bar{c}d + \bar{a}b\bar{c}d$

0000 1000 0001 0101 1101 0001 0010 010

AB \ CD	00	01	11	10
00	1			1
01	1	1	1	
11	1			
10	1			1

$$\bar{a}\bar{b} + \bar{b}\bar{c}d + \bar{b}\bar{c}$$

! Lau eskinetan
dovdinele, talde bat
osatu derakete

2.20

0000
0001
0011
0010
0100
0101
0111
0110
1111

AB \ CD	00	01	11	10
00	0	0		
01	0	0		
11	0	0	0	
10	0	0	0	

$$A \cdot (\bar{B} + \bar{C} + \bar{D})$$

2.21

0000
0100
1000
1100
1010
1011
1100
1111
0001
0011
0010

AB \ CD	00	01	11	10
00	1	1	1	1
01	1			
11	1		1	1
10	1		1	1

$$\bar{a}\bar{b}\bar{c}\bar{d} + AC$$

2.22

1100
1110
0000
0010
1000
1010

AB \ CD	00	01	11	10
00	0			0
01				
11				
10	0		0	0

$$\bar{A}\bar{B}\bar{C}\bar{D} + \bar{B}\bar{C}$$

$$(\bar{A} + D)(\bar{B} + D)$$

2.23

AB \ CD	00	01	11	10
00	0	1	0	0
01	0	1	0	0
11	1	1	1	1
10	1	0	1	1

maxterms $(\bar{A} + C)(B + C)(A + \bar{B} + \bar{C} + D)$

minterms $CD + AC + \bar{A}B\bar{C} + \bar{B}\bar{C}$

ED - II - Aristoteles - OK

2.24

$\overline{A}B$	00	01	11	10
00		1	X	1
01	1	1	X	X
11				
10			1	1

$$\overline{B}\overline{C} + \overline{C}D$$

2.25

$\overline{A}B$	00	01	10	11
00	1	1	0	X
01	1	0	0	0
10	1	X	0	X
11	1	1	0	1

$$(\overline{A} + \overline{B})(\overline{B} + \overline{D})(\overline{A} + \overline{D})$$

$$\overline{A}\overline{B} + \overline{A}\overline{D} + \overline{A}\overline{C} + \overline{B}\overline{C}$$

2.26

01111
00011
01100
01000
11000
00001
10001
11111
10011
10110

$\overline{A}BC$	000	001	011	010	110	111	101	100
00			1	1	1			
01	1							1
11	1		1			1		1
10							1	

2.27

00000 0
00001 1
00010 2
00011 3
00100 4
00101 5
00110 6
00111 7
~~00100 4~~
~~00101 5~~
~~00110 6~~
~~00111 7~~
01001 9
01011 12
01101 17
01101 18
01101 25
01101 29
01011 11
01111 15
11011 27
11111 31
~~10000 0~~
~~10001 1~~
10010 13
10011 14
10100 20
~~10101 21~~
10110 22
10111 23

$\overline{A}B$	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	1	1
10	1	1	1	1

$$E=0$$

$$A\overline{E} + A\overline{B}\overline{E} + A\overline{B} + \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}\overline{D}$$

$$A\overline{E}(1 + \overline{B}) + A\overline{B} + \overline{A}\overline{B}(\overline{C} + \overline{D})$$

$$E=1$$

$$A[E + \overline{B}]$$

$$\overline{B}[A + \overline{A}(\overline{C} + \overline{D})] + A\overline{E}$$

$\overline{A}B$	00	01	11	10
00				
01				
11				
10				

$$E=0$$

$\overline{A}B$	00	01	11	10
00				
01				
11				
10				

$$E=1$$

228

AB \ CD	00	01	11	10
00	1			1
01	1			1
11		1	1	
10	1	1	1	1

E=0

5 Falden

AB \ CD	00	01	11	10
00				1
01				
11		1	1	
10	1	1	1	1

E=1

$$\overline{C}\overline{D} + \overline{A}BC\overline{D} + \overline{A}B\overline{C}D + \overline{B}\overline{C}\overline{D} + \overline{A}B\overline{C}\overline{D}$$

$$\overline{C}\overline{D} + \overline{A}BC\overline{D} + \overline{A}B\overline{C}D + \overline{B}\overline{C}\overline{D} + \overline{A}B\overline{C}\overline{D}$$

Beitragweise kartesische Produkt: rechnerisch kombinatorisch

a) $(+5) + (+2) = (+7)$

$$\begin{array}{l} 0101 \rightarrow 1010 \rightarrow 1011 \\ 0010 \rightarrow 1101 \rightarrow 1110 \\ 0111 \rightarrow 1000 \rightarrow 1000 \end{array}$$

$$\begin{array}{r} 0101 \\ 0010 \\ \hline 0111 \end{array}$$

$$\boxed{0111} \rightarrow 0110 \rightarrow 1001$$

b) $(-5) + (+2) = (-3)$

$$\begin{array}{l} 0101 \rightarrow 1010 \rightarrow 1011 \\ 0010 \rightarrow 1101 \rightarrow 1110 \\ 0111 \rightarrow 1100 \rightarrow 1100 \end{array}$$

$$\begin{array}{r} 1011 \\ 1010 \\ \hline 1001 \end{array}$$

$$\rightarrow 1100 \rightarrow \boxed{0011}$$

$$\begin{array}{r} 1011 \\ 0010 \\ \hline 1101 \end{array} \rightarrow 1100 \rightarrow 0011$$

c) $(+5) + (-2) = (+3)$

$$\begin{array}{l} 0101 \rightarrow 1010 \\ 1110 \rightarrow 2001 \end{array}$$

$$\boxed{0001} \rightarrow 0010 \rightarrow 1101$$

oder dabei systematisch mit zwei Bits behandeln
einmalige negativen Zahlen, bzw. addieren, positivem haben den

$$\begin{array}{r} 1011 \\ 0010 \\ \hline 1101 \end{array} \rightarrow 1100 \rightarrow 0011$$

d) $(-5) + (-2) = (-7)$

$$\begin{array}{l} 1011 \rightarrow 2001 \\ 1110 \rightarrow 2001 \end{array}$$

$$\begin{array}{r} 1011 \\ 1110 \\ \hline 1001 \end{array} \rightarrow 1000 \rightarrow 0111$$

$$\begin{array}{l} 101 \rightarrow 010 \rightarrow 011 \\ 010 \rightarrow 101 \rightarrow 110 \end{array}$$

beste bit bei beiden: 1er digit beiden.

$$\boxed{1001} \rightarrow 1000 \rightarrow 0111$$

e) $(+5) - (+2) = (+3)$

$$\begin{array}{l} 0101 \rightarrow 1010 \\ 1110 \rightarrow 2001 \end{array}$$

$$\boxed{0011} \rightarrow 0010 \rightarrow 1101$$

ES-5 - Addition - 010

f) $(-5) - (-2) = (-7)$

$$\begin{array}{r} 0101 \rightarrow 1010 \rightarrow 1011 \\ 0010 \rightarrow 1101 \rightarrow 1110 \end{array}$$

$$\begin{array}{r} 1011 \rightarrow b.6 \\ 1110 \rightarrow b.6 \end{array}$$

$$\hline 0001 \rightarrow 0000 \rightarrow 1111 \rightarrow$$

g) $(+5) - (-2) = (+7)$

$$\begin{array}{r} 0101 \text{ normal} \\ 0010 \text{ normal} \end{array}$$

$$\boxed{0111}$$

h) $(-5) - (-2) = (-3)$

$$\begin{array}{r} 1011 \text{ b.6} \\ 0010 \text{ normal} \end{array}$$

$$\hline 1101 \rightarrow 1100 \rightarrow \boxed{0011}$$

i) $(+2) + (+2) = +4$

$$\begin{array}{r} 0111 \rightarrow 1000 \rightarrow 1001 \\ 0010 \rightarrow 1101 \rightarrow 1110 \end{array}$$

$$\begin{array}{r} 1001 \\ 1110 \\ \hline 1011 \end{array} \quad \begin{array}{r} 0111 \\ 0010 \\ \hline \boxed{1001} \end{array}$$

j) $(-2) + (+2) = -5$

$$\begin{array}{r} 1001 \\ 0010 \\ \hline 1011 \end{array} \rightarrow 1010 \rightarrow \boxed{0101}$$

k) $(+2) + (-2) = (+0)$

$$\begin{array}{r} 0111 \\ 1110 \\ \hline \boxed{0101} \end{array} \rightarrow 10100 \rightarrow 01011$$

$$\begin{array}{r} 0111 \rightarrow 1000 \rightarrow 1001 \\ 0010 \rightarrow 1101 \rightarrow 1110 \end{array}$$

$$\begin{array}{r} 0111 \\ 1110 \\ \hline 1001 \end{array}$$

l) $(+2) + (-2) = (-4)$

$$\begin{array}{r} 1001 \\ 1110 \\ \hline 1011 \end{array} \rightarrow 10110 \rightarrow \boxed{01001}$$